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Writing E-Learning Materials for Construction Management Subjects

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Abstract

Our faculty, Szent István University's Ybl Miklós Faculty of Architecture and Civil Engineering is currently conducting a project, whose main goal is to develop up-to-date e-learning study materials for Construction Management BSc students. The project is being carried out within the framework of the New Széchenyi Plan; and it is co-funded by the European Social Fund. The start of the project was in March 2012, while the finish will be at the end of 2013.

Materials are written for the curriculum's core subjects: Technical Documentation, Building Structures, Construction Technology and Construction Management. They are complete with numerous graphics, tables, videos, even interactive ones and countless examples and tasks in order to facilitate better understanding.
This paper introduces the project and describes the elements of the materials written for the above-mentioned core subjects. It also discusses the experience and conclusions of writing such materials.

Keywords: activity distribution ; PERT; sensitivity analysis.

1. Introduction

In this paper, we examine the effect of the application of different activity distributions on the distribution of the

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Szent István University's Ybl Miklós Faculty of Architecture and Civil Engineering – hereinafter referred to as Ybl – has been working out the curriculum of a new Construction Management BSc program which complies with the European and international standards. Unfortunately, such a program is currently absent in Hungary, even though it is really essential to train experts who know the technical, as well as the legal and economic sides of the construction projects, and who can also perform management duties. Hopefully, the program can be launched soon.

Students are going to get acquainted first with the basic subjects, like Mathematics and Mechanics. Then they will acquire basic engineering knowledge complemented with construction economics and law. Construction Management 1-4, Construction Technology 1-4, Building Constructions 1-4 are going to constitute the core of the new program. In order for it to comply with the demands of the 21st century, students are going to obtain advanced IT skills, as well. For example, they are going to learn how to use Building Information Modeling tools.

In this paper, we are only focusing on the above-mentioned core subjects, since currently Ybl is taking part in a Social Renewal Operative Program within the framework of the New Széchenyi Plan run by the National Development Agency. The project started on 1 March 2012; and it is going to end on 31 December 2013. 95% of the budget is subsidized; it is co-funded by the European Social Fund. The aim of the project is to develop e-learning study materials for these subjects.

Many people are involved in this project. Most of the materials are written by teachers from Ybl. Some of them are put together by teachers from the Budapest University of Technology and Economics. In some cases, experts from the construction industry are of help.

Every material is in Hungarian, however, the Construction Management 1-4 lessons are going to be translated to English as well.

2. Overview of the core subjects

Technical Documentation is the first one that the students are going to meet, as it will be taught in the first semester. Its main aim is to get the students acquainted with the basic requirements of technical drawings, the usual notations and symbols. As construction managers, they will not make these drawings, however, their jobs will demand them to be able to read them and to know what a proper documentation should consists of.

The other 12 subjects are going to be taught parallel to each other starting from the second semester. While the Building Constructions subjects show the students all the structures and works that they can see in their professional lives, Construction Technology is responsible for explaining them how these can be constructed, how the different works have to be performed. Building Constructions 1 deals with earthworks, foundations, insulations and public works. In the next term, students continue with load-bearing structures, monolithic and prefabricated structures, masonry works, stairs and elevators. Building Constructions 3 introduces flat and pitched roofs, cladding and doors and windows. Lastly, students are familiarized with curtain walls, partition walls, floor structures and finishes and building services engineering. In accordance with the above-mentioned topics, Construction Technology 1 gets the students acquainted with the preparation for the on-site works, demolition works, earthworks and foundations concentrating on the machinery used and the steps of the different technologies. The same approach is true for the monolithic and prefabricated concrete, masonry and roof structures taught in the third semester. Construction Technology 3 deals with the construction of flat and pitched roofs, non-load-bearing external and partition walls. Finally, scaffoldings, cladding, floor and wall finishes, doors and windows are discussed from a technological point of view.

Construction Management is also taught for four semesters. The first one gives an introduction to the world of investments. The various stakeholders and the entire process are also described in detail. Moreover, students are given a sneak peek into the following three semesters. In order for them to see the connection between their subjects better, the relationships between scheduling and site layout design is also discussed. Construction Management 2 deals with the construction budget. Different Hungarian and European norm databases, cost estimation methods and practices are introduced. Next, the students get acquainted with various scheduling techniques from the traditional to the most modern ones together with resource planning. Construction Management 4 looks over the construction process from the point of view of the documents that have to be collected and issued in this period of the projects. Furthermore, safety measures and quality assurance are also discussed.

3. Elements of study materials

In case of each subject an average of 14 lessons are written corresponding with the number of lectures in a semester. This way the titles of the lessons constitute the curriculum of the given subject for one semester. This also means that the contents of one lesson should not exceed the time limit of one lecture, which is usually 90 minutes. On the other hand, the materials have to contain extra information for those who are interested in the subjects and extra examples and task for the students to be able to prepare for the tests and exams.

Each lesson is divided into chapters, and these are made up of pages. The website-like appearance provides easy navigation between the various parts. See, for example, Figure 1. The three rows of text on the top show you the subject, the lesson and the chapter respectively. The latter one is also indicated on the “timeline” below. In case of Figure 1, we are looking at Construction Management 3’s fourth lesson: CPM: Time Analysis, Evaluation of Results, whose second chapter is CPM Time Analysis. The little squares in the top right corner represent the pages of the chapter. The orange one indicates the current page.

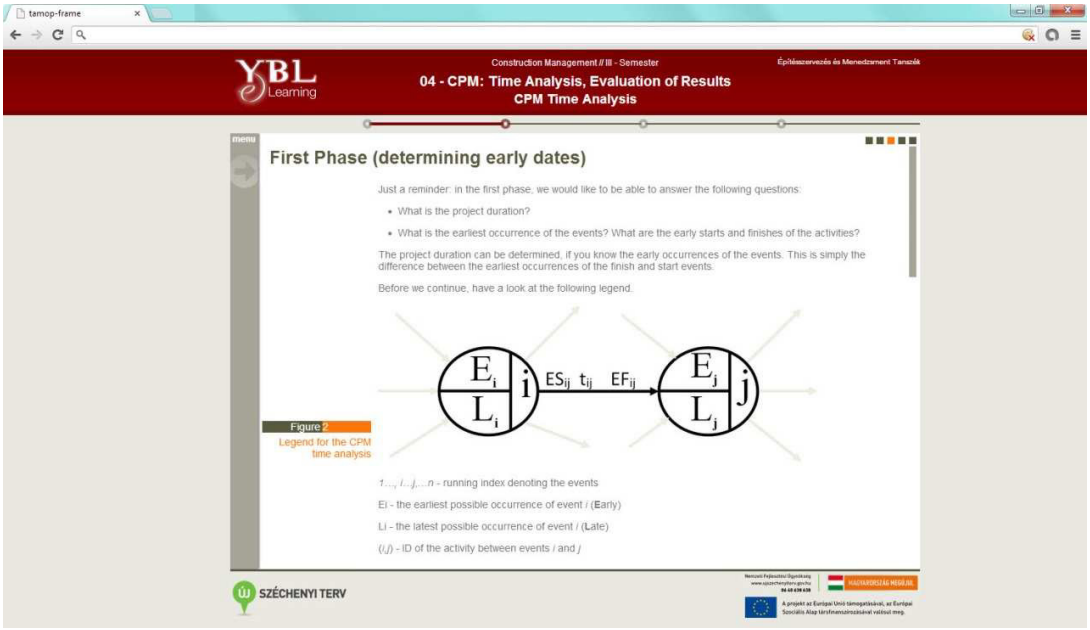

Figure 1: One page from CPM: Time Analysis, Evaluation of Results (fourth lesson of Construction Management 3)

Every lesson is made up of different elements. These are the following: text, figures, interactive videos, non-interactive videos, tasks. The planned amount of each element is given in case of all lessons.

Naturally, the text is the most essential part of the study materials. Being digital means that even the text could be enhanced. The most important definitions appear in pop-up bubbles after clicking on the words. Also links can be added to the text. These can be divided into two groups. To the first one belong those links that point to a certain part of another lesson either of the same or of another subject, thus enabling the connection between the lessons. The other group includes those links that lead to websites, where students can find extra information in the form of texts, figures or videos etc.

Figures can include many different types, as well. There can be tables, photos, sketches created by the authors or obtained from external sources. It is especially important in case of the Construction Technology subjects to illustrate the text with figures. Sketches can show the theory, while the photos shot at various construction sites demonstrate the practice.

Interactive and non-interactive videos can also appear in the materials due to the fact that they are going to be accessed through the internet and not on paper. The difference between the two types is that in case of interactive videos students are more involved; they can choose what they would like to see. These videos can serve different purposes. In case of Building Constructions and Construction Technology, there are 3D videos, where the point of view can be changed and the model can be looked at from all angles. There is, for example, a video that shows the construction of a roof structure step by step. In case of Construction Management, videos can also demonstrate a process, like how to perform the time analysis of a CPM network, summarize the text and figures of the lesson, for instance to sum up all the data a table in a norm database contains, or provide additional information on a topic discussed, for example, display pages from old books on how to calculate the construction costs. Another example can be seen on Figure 2. This video shows how to perform the first phase of the CPM time analysis. Those students who are unsure of their CPM calculation skills can just watch the video. Once they get more confident, they can determine the early and late occurrences of the events on their own, and check their solution.

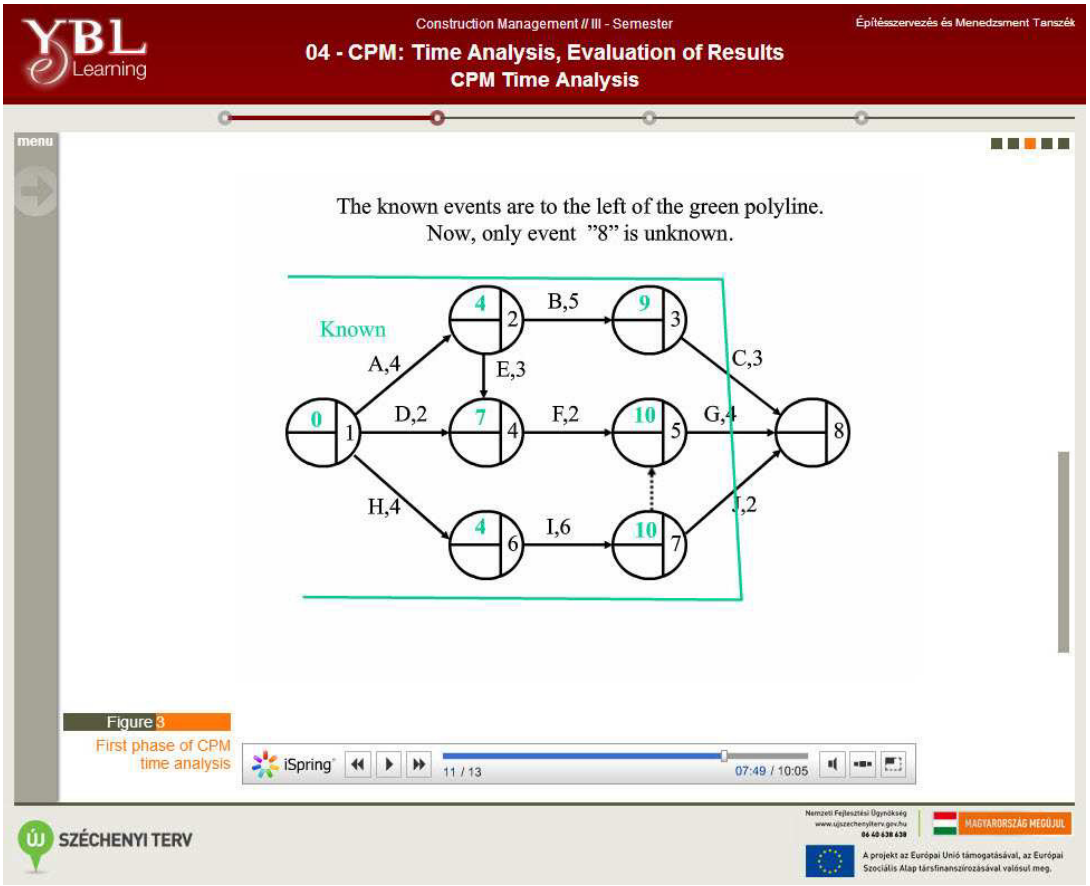

Figure 2: A video embedded in the material

Tasks can be found at various places in the lessons. They are usually at the end of the chapters or lessons. They can be of different types. There are, for example, multiple choice and multiple response questions. If the right answer is ticked, the smiley is going to smile (Figure 3), if not, it gets sad/angry (Figure 4).

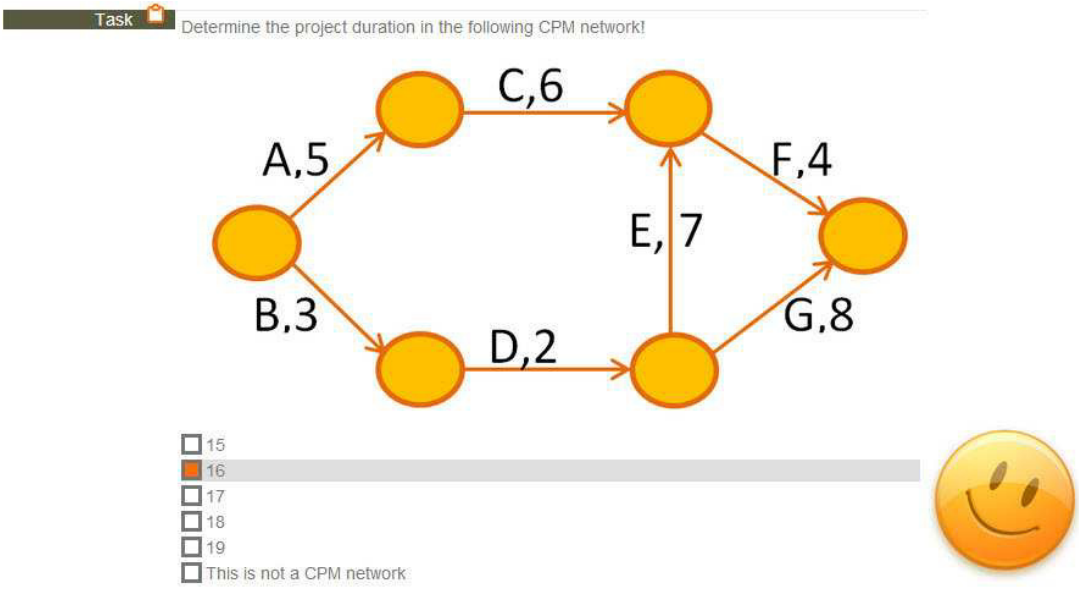

Figure 3: Smile for the right answer

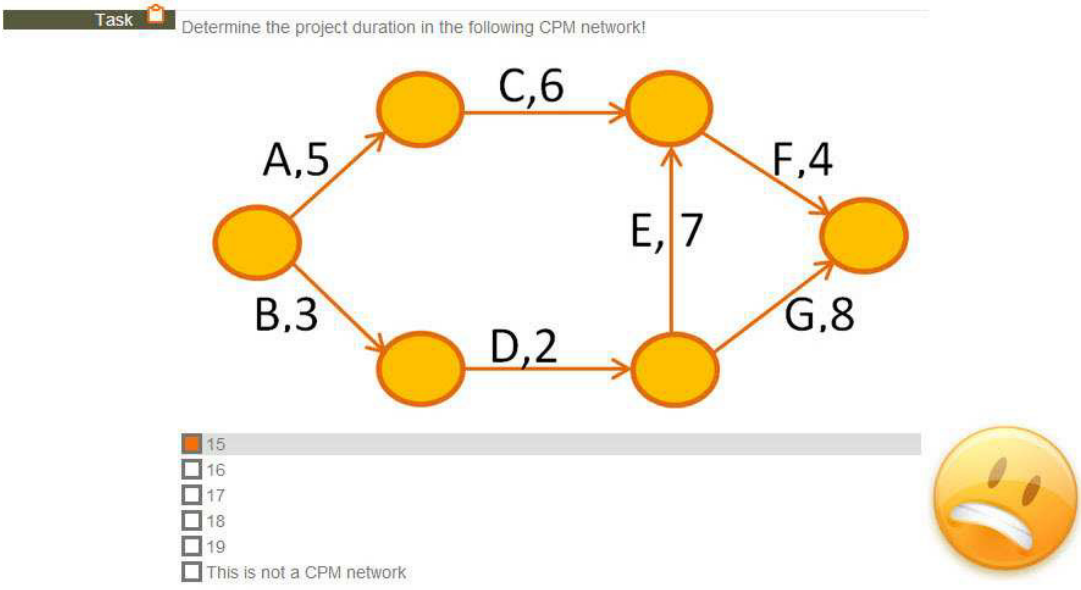

Figure 4: Angry face for the wrong solution

In case of multiple response questions, when more than one answer has to be checked for the right solution, the face only appears when all of them are ticked. (See Figure 5.)

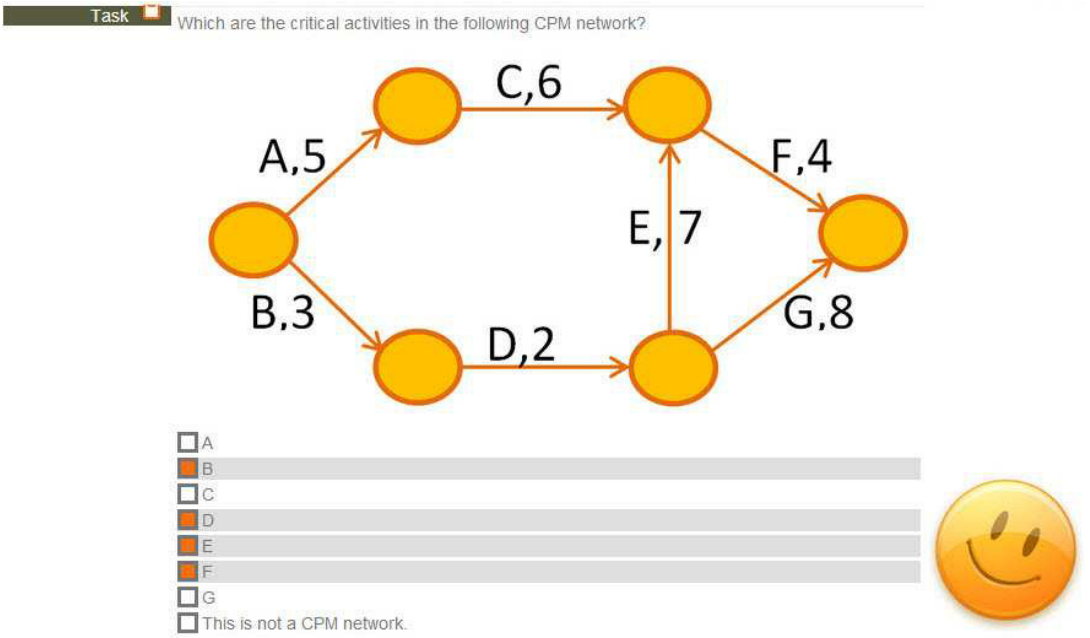

Figure 5: All right answers have to be checked

Some tasks require calculations. In case of one half of these tasks, the solutions are given, and can be reached by the students when they would like to see them. In case of the other half, the answers are not provided.

No matter what type the exercise belongs to, they all serve the same purpose. They measure the students' level of understanding. This way they would know what parts of the lesson they have to go through again.

Every lesson ends with a bibliography. This, on the one hand, is important, because we do not want to commit plagiarism, so we always properly apply references. On the other hand, we could add extra sources of information, as well, for students who are interested in certain topics.

4. Challenges

In spite of the fact that the project is not over yet, we have already faced lots of challenges. The first one was to create the curriculum of the subjects, thus the titles of the lessons. It was important to include all essential topics; however, there was no way to contain everything. We had to bear in mind that these materials are for BSc students, therefore everything had to be tailored to their level. This is also true for each lesson. As mentioned before, every lesson corresponds with one lecture in a semester, thus the length of one lesson is limited by this fact. On the other hand, additional information can be provided for students who are more eager to learn. Moreover, the large number of tasks helps everyone prepare for the tests and exams.

Another issue is uniformity, both in appearance and language. The first aspect is the easier of the two. Every author uses the same template; furthermore, an editor creates the final shape of the materials. Finally, our colleague responsible for the IT solutions translates the Word files into webpages. The second one is a little more difficult. We agreed at the beginning that we would try to keep the tone informal. Again, due to the fact that we are writing these materials for BSc students, who are usually in their late teens, early twenties, we would like to adapt to that.

This endeavor is what explains the great amount of figures and videos, as well. Firstly, owing to the fact that we are in the 21st century when young people do not necessarily like to read and when everything is accelerated. And secondly, because we believe that engineers (now including construction managers), even prospective ones, are "visual" learners. Thirdly, due to the fact that sometimes it is easier to explain something with a sketch, figure or video, than with words or formulae. For example, how to build a prefabricated concrete hall or how to perform the time analysis in a PDM network.

Moreover, it is imperative for every lesson to contain the most up-to-date information. This is achieved by thorough research, discussing certain topics with experts working in the construction industry. The two project managers, who are also industry professionals, overlook the project in this sense as well. They are also keen on the practicality aspect of the materials. Since Ybl traditionally trains professionals who are going to work for contractors, rather than design firms, the introduction of the practical application of the theory has always been top priority.

5. Applications and results

As stated before, the goal of the project is to develop study materials for Construction Management BSc students. However, these lessons can be very well used in case of Architecture and Civil Engineering students, who we are already teaching. Also, we hope these could be used by our part-time students, and they can be helpful for distance-learning ones as well. Developing e-learning materials could be the first step for moving onto blended learning, and finally virtual classrooms.

To comply with the new requirements of the 21st century, the materials can be accessed via the internet from anywhere in the world. Despite this and the fact that these materials are enough for a five (best grade in the Hungarian educational system), they cannot fully substitute the traditional way of studying, attending lectures. Firstly, because students learn easier when they use many of their senses (sight, hearing etc.), and secondly, owing to the teacher-student and student-student interaction that can happen in school, which all add to the learning experience and provide internal motivation. At Ybl, we are already using a kind of course management system, which is based on moodle (modular object-oriented dynamic learning environment). Here students can find lecture and practice presentations, upload their homework assignments, write tests etc. They also have the opportunity to leave comments in the forum, which enables the above-mentioned interactions. However, due to its asynchronous nature, it still cannot fully replace face-to-face classes. This means that later a couple of additional functions can complete the study materials.

Even though the end of the project is December 31, 2013, we plan on updating the lessons from time to time, and complement them with new technologies, techniques and methods. Some of them also refer to laws and regulations, which are changing rapidly; therefore these parts have to be updated too.

Another part of the project is the education of teachers. It means that we have weekly meetings, when a few lessons are introduced to the others. This practice has many advantages. One is that this way everyone gets acquainted with all the topics of each subject. On the other hand, the colleagues can share their objective opinion and provide feedback, thus enabling the author to make the given material better, while also drawing conclusions regarding their own lessons. In brief, we can learn from each other and teach each other at the same time.

In conclusion, it can be stated that we are striving for making up-to-date and practical study materials complying with the requirements of the 21st century for the new Construction Management BSc students, while hoping they could also be well used in case of other programs.